

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (currently amended): A pump assembly for flowing high-pressure liquid to one or more components of an internal combustion engine having an ECM and a sump; the pump assembly including a high-pressure pump; a pump inlet passage; a pump outlet passage; a hydraulic inlet throttle valve for flowing liquid to the pump through the inlet passage, the inlet throttle valve including a spool moveable between open and closed positions, ~~a~~ an inlet throttle spring biasing the spool toward the open position, a hydraulic chamber, the spool including a piston forming a wall of the chamber wherein liquid of the chamber biases the spool toward the closed position against the spring; and a hydraulic circuit including a first flow path extending from the outlet passage to the inlet throttle valve chamber; a second flow path extending from the inlet throttle valve chamber to the sump, and a first fast acting two position on/off control valve located in said first path, such control valve including a first valving member having a fully open valve position and a fully closed valve position, a first spring biasing the valving member to one of said positions, a first solenoid for moving the valving member to the other of said positions when actuated, and a connection between the ECM and the solenoid wherein actuation and deactuation of the solenoid by the

ECM rapidly shifts the valving member between said positions without modulating flow through the valve to flow liquid from the outlet passage to the inlet throttle valve or isolate the inlet throttle valve from the outlet passage.

2. (original): The pump assembly as in claim 1 including a second fast acting two position on/off control valve located in said second path.

3. (new): The pump assembly as in claim 2 wherein the second control valve comprises a second solenoid and a second valving member.

4. (new): The pump assembly as in claim 3 wherein said first and second control valves comprise a dual solenoid controlled valve.

5. (new): The pump assembly as in claim 1 wherein the first spring biases the first valving member toward a fully closed position, and the first solenoid biases the first valving member toward a fully open position, wherein the inlet throttle valve is open at startup of the engine.

6. (new): The pump assembly as in claim 1 wherein the first spring biases the valving member toward the fully open position and the first solenoid biases the valving member toward the fully closed position.

7. (new): The pump assembly as in claim 1 wherein said hydraulic circuit includes a pressure line connected to the inlet throttle valve chamber, the pressure line forming a portion of said first flow path and said second flow path, and including a

restriction in said pressure line, wherein said restriction slows movement of the inlet throttle valve spool toward the closed position.

8. (new): The pump assembly as in claim 1 including a restriction, said restriction located in said first flow path or in said control valve, said restriction reducing the pressure of liquid flowed to the inlet throttle valve.

9. (new): The pump assembly as in claim 8 wherein the restriction is located between the control valve and the inlet throttle valve.

10. (new): The pump assembly as in claim 1 including a restriction in one of said flow paths.

11. (new): The pump assembly as in claim 10 wherein said restriction is in said first flow path to slow shifting of the inlet throttle valve spool upon opening of the first control valve.

12. (new): The pump assembly as in claim 10 wherein the restriction is in the second flow path to provide a pressure at the chamber when the first control valve is open.

13. (new): The pump assembly as in claim 1 wherein said control valve is normally open.

14. (new): The pump assembly as in claim 1 wherein said control valve is normally closed.

15. (new): A pump assembly for flowing high-pressure liquid to one or more components of an internal combustion engine having an ECM and a sump; the pump assembly including a high-pressure

pump; a pump inlet passage; a pump outlet passage; a hydraulic inlet throttle valve for flowing liquid to the pump through the inlet passage, the inlet throttle valve including a spool moveable between open and closed positions, a spring biasing the spool toward the open position, a hydraulic chamber, the spool including a piston forming a wall of the chamber wherein liquid of the chamber biases the spool toward the closed position against the spring; and a hydraulic circuit including a first flow path extending from the outlet passage to the inlet throttle valve chamber; a second flow path extending from the inlet throttle valve chamber to the sump, and a first two position control valve located in said first path, a second two position control valve located in said second path, each control valve including a valving member having a fully open valve position and a fully closed valve position, a spring biasing the valving member toward one of said positions, a solenoid for moving the valving member toward the other of said positions when actuated, and a connection between the ECM and the solenoid wherein alternate actuation and deactuation of the solenoids by the ECM rapidly shifts the valving members between said positions without modulating flow through the valves to flow liquid from the outlet passage to the hydraulic chamber inlet throttle valve or flow liquid from the hydraulic chamber in the inlet throttle valve to the sump.

16. (new): The pump assembly as in claim 15 wherein in one control valve the spring biases the valving member toward the closed position.

17. (new): The pump assembly as in claim 15 wherein in one control valve the spring biases the valving member toward the open position.

18. (new): The pump assembly as in claim 15 including a restriction in one of said flow paths.

19. (new): The method of pumping high-pressure liquid to one or more components of an internal combustion engine of the type having a high-pressure pump, a high-pressure outlet passage extending from the pump to the one or more components, a low-pressure inlet passage extending to the pump, a hydraulic inlet throttle valve in the inlet passage, the inlet throttle valve having a spool, a spring biasing the spool toward an open position and a hydraulic chamber for pressurized liquid to bias the spool toward a closed position, a first flow path between the outlet passage and the hydraulic chamber, a sump and a second flow path between the hydraulic chamber and the sump, comprising the steps of:

a) increasing flow of liquid through the inlet throttle valve and to the high-pressure pump when the pressure in the outlet passage is less than a desired pressure by opening an on-off valve in the first flow path to flow high-pressure liquid from the outlet passage to the hydraulic chamber; and

b) decreasing flow of liquid through the inlet throttle valve and to the high-pressure pump when the pressure in the outlet passage is greater than a desired pressure by closing the on-off valve in the first flow path and flowing liquid in the hydraulic chamber to sump.

20. (new): The method as in claim 19 including the step of:

c) maintaining a flow of liquid through the inlet throttle valve and to the high-pressure pump to maintain a pressure in the outlet passage by preventing flow of liquid to or from the hydraulic chamber.

21. (new): The method as in claim 19 including the step of:

c) slowing movement of the spool toward the closed position by flowing liquid from the outlet passage to the hydraulic chamber through a restriction.

22. (new): The method as in claim 19 including the step of:

c) alternately flowing high-pressure liquid from the outlet passage to the hydraulic chamber; or flowing liquid from the hydraulic chamber to sump.